

**Charge transport in random media and Boltzmann limits
for single particle and manybody models**

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Abstract:

In the first part of the talks, we will discuss the quantum dynamics of an electron in a random medium, as described by the weakly disordered Anderson model. First, we will survey the derivation of the Boltzmann limit, in the sense of convergence in distribution, which describes the quantum dynamics of the system, averaged over the randomness. Subsequently, we will explain how to prove convergence in higher mean (and thus in probability) which implies that the average dynamics is typical. The papers containing these works include some joint lemmata with L. Erdos and H.-T. Yau. Furthermore, we will discuss models with decaying random potential in 2-D, and study the relationship between decay exponent, scattering, and conjectural localization. In particular, it is explained how those question can be interpreted in the renormalization group context. We present lower bounds on localization lengths which interpolate between recent results of Bourgain in the scattering regime, and of Schlag, Shubin and Wolff, in the conjectural localization regime.

In the second part of the talks, we explain how the techniques above can be applied to study free fermion gases in weakly disordered random media. In particular, we demonstrate how to derive the Boltzmann limit for the thermal momentum distribution function, and how to establish persistence of quasifreeness of the initial data in the Boltzmann limit. This is based on joint work with I. Sasaki. Moreover, some new results about related, but more involved systems are presented, based on an ongoing joint work with I. Rodnianski.